

WHAT IS CLAIMED IS:

1                   1.     An apparatus for forming a pattern on a surface of a  
2     substrate comprising:

3                         a probe chip, said probe chip comprising a plurality of  
4     probes arranged in an array along said probe chip, the array being one of one-  
5     dimensional and two-dimensional, each of said plurality of probes having a tip;

6                         a first actuator for moving the probe chip parallel to the  
7     surface of the substrate;

8                         said probe chip further comprising a plurality of second  
9     actuators operatively connected to each of the plurality of probes, for  
10    selectively raising or lowering the tip of each of the probes in a direction  
11    substantially perpendicular to the surface of the substrate;

12                        a source connected to each of the plurality of second  
13    actuators for selectively actuating the plurality of second actuators.

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15                   2.     The apparatus of claim 1 wherein each of said second  
16    actuators is configured to move the tip of a selected probe away from the  
17    substrate upon actuation of a selected second actuator.

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19                   3.     A substrate having a pattern of a patterning compound on  
20    its surface, said pattern being produced by a method comprising the steps of:

21 moving a chip over the substrate to position a plurality of  
22 probes over said substrate simultaneously;  
23 selectively actuating at least one of the plurality of probes  
24 to place the probes in one of in contact and out of contact of the substrate,  
25 while at least another of the plurality of probes remains out of contact with the  
26 substrate; at least the plurality of probes placed in contact with the substrate  
27 having a tip and the patterning compound on the tip;  
28 wherein the pattern is formed by application of the  
29 patterning compound from the tip to the substrate.  
30

31 4. The substrate of claim 3 wherein the patterning compound  
32 comprises a biological compound.  
33

34 5. The substrate of claim 3 wherein, when the at least one of  
35 the probes is placed in contact with the substrate, the tip of each of the in-  
36 contact probes is within a sufficient distance of the substrate to permit  
37 patterning of the patterning compound.  
38

39 6. The substrate of claim 3 wherein the patterning compound  
40 comprises at least two different types of patterning compounds.  
41

42 7. The substrate of claim 3 wherein the substrate is a  
43 patterned integrated circuit.

44                   8.     The substrate of claim 3 wherein the patterning compound  
45 comprises at least one of octadecanethiol (ODT) and mercaptohexadecanoic  
46 acid (MHA).

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48                   9.     The substrate of claim 3 wherein lines are formed by  
49 selected probes in contact with the substrate, the lines being less than 100 nm  
50 in width.

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52                   10.    The substrate of claim 3, wherein the substrate comprises  
53 gold.

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55                   11.    An apparatus for applying a patterning compound to a  
56 substrate for nanolithography, the apparatus comprising:

57                         a plurality of scanning probe microscope (SPM)  
58 instrument probes arranged in an array;

59                         an actuator operatively connected to each of the plurality  
60 of AFM probes for selectively actuating each of the probes, thus placing a tip  
61 of each of the selectively actuated probes in sufficient proximity to the  
62 substrate to allow application of the patterning compound thereto.

63

64                   12.    The apparatus of claim 11 wherein the plurality of SPM  
65 probes are disposed on a probe chip.

66

- 67                    13.    The apparatus of claim 12 further comprising:  
68                                    a scanner tube for moving the probe chip.  
69  
70                    14.    The apparatus of claim 13 wherein the scanner tube uses  
71    piezo-actuation.  
72  
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